

FIG.1

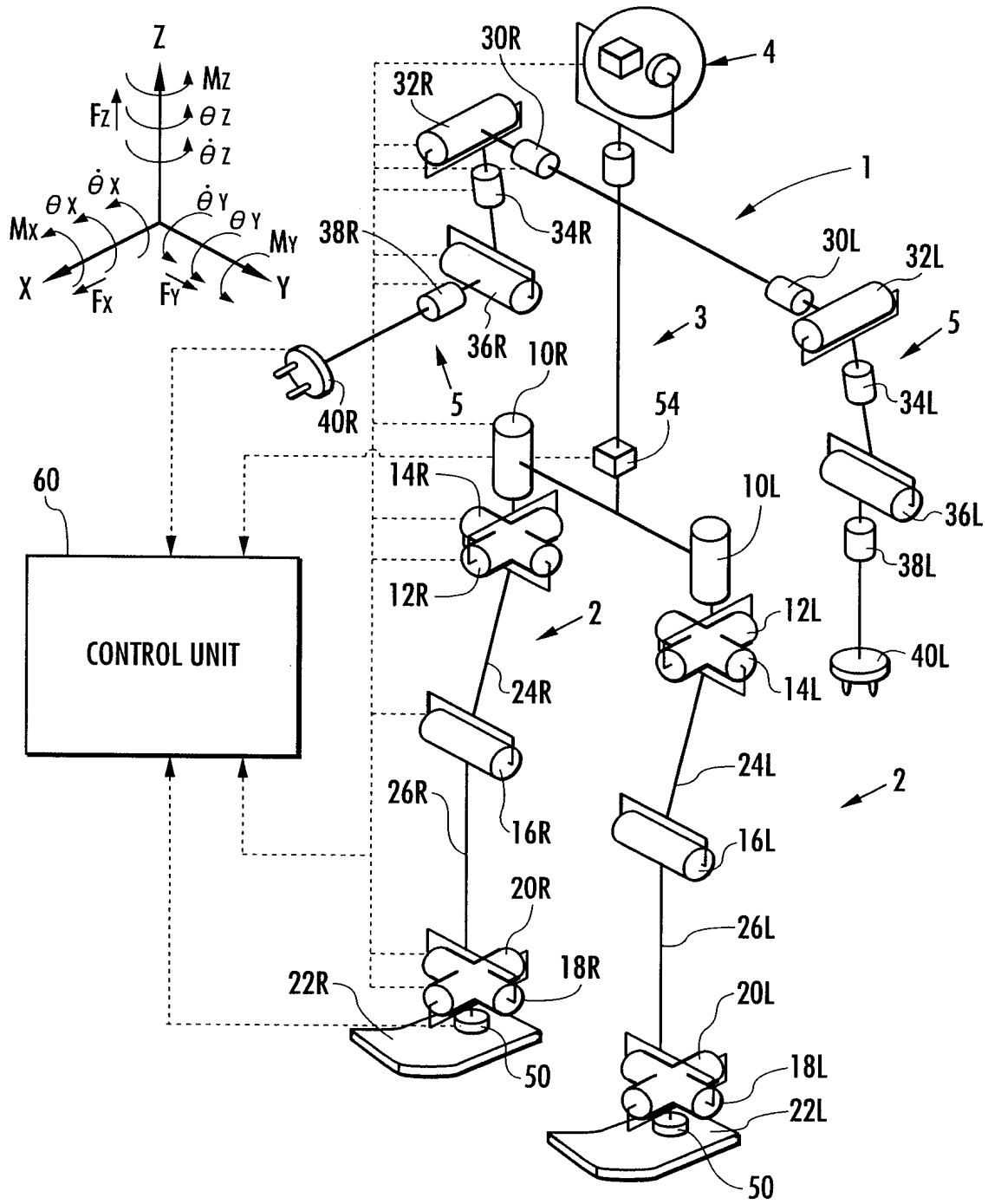


FIG.2

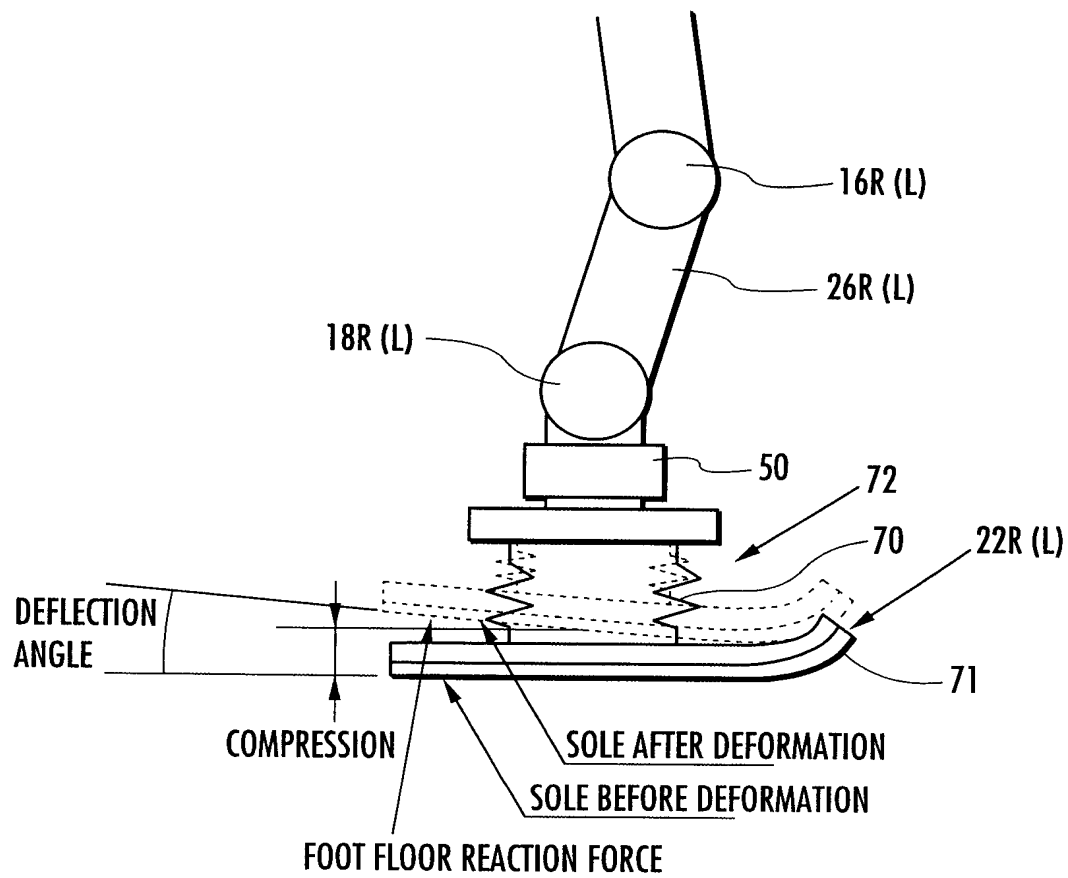


FIG.3

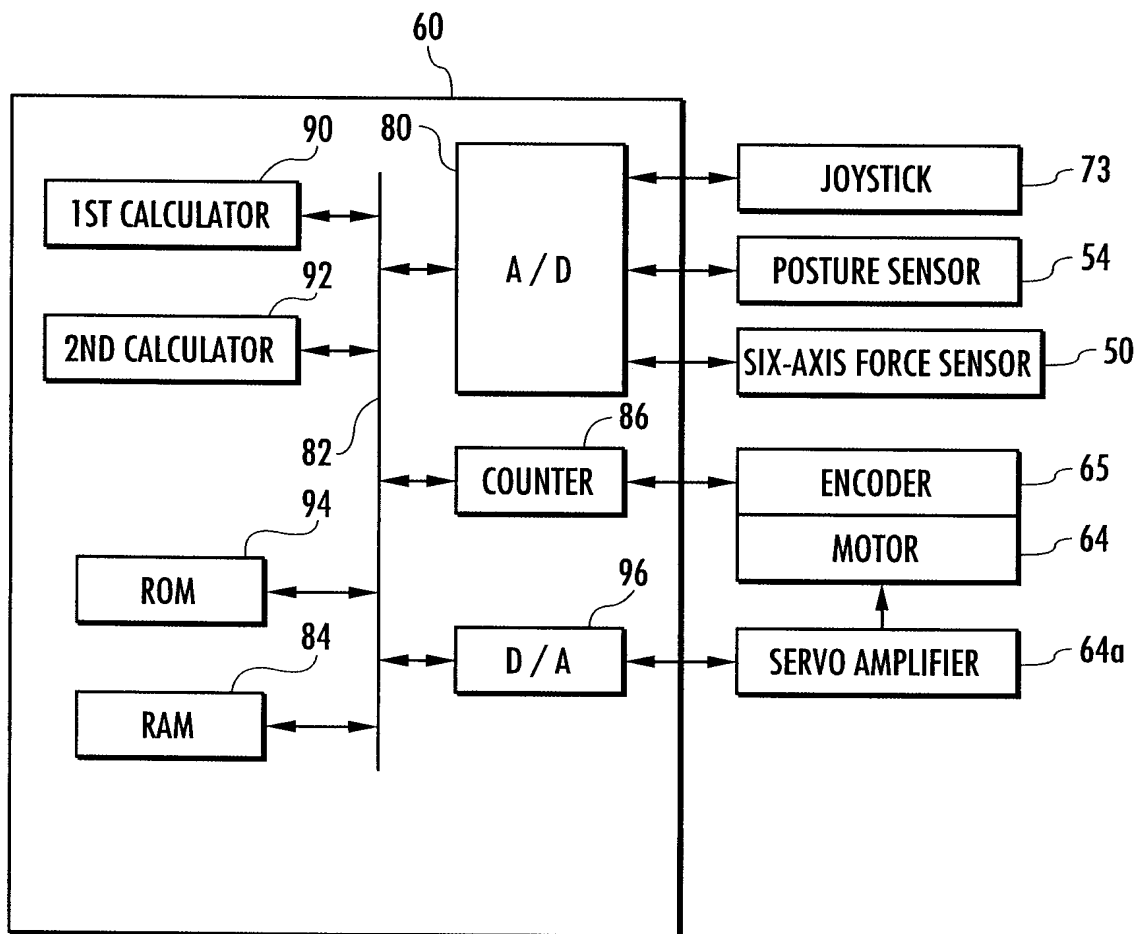
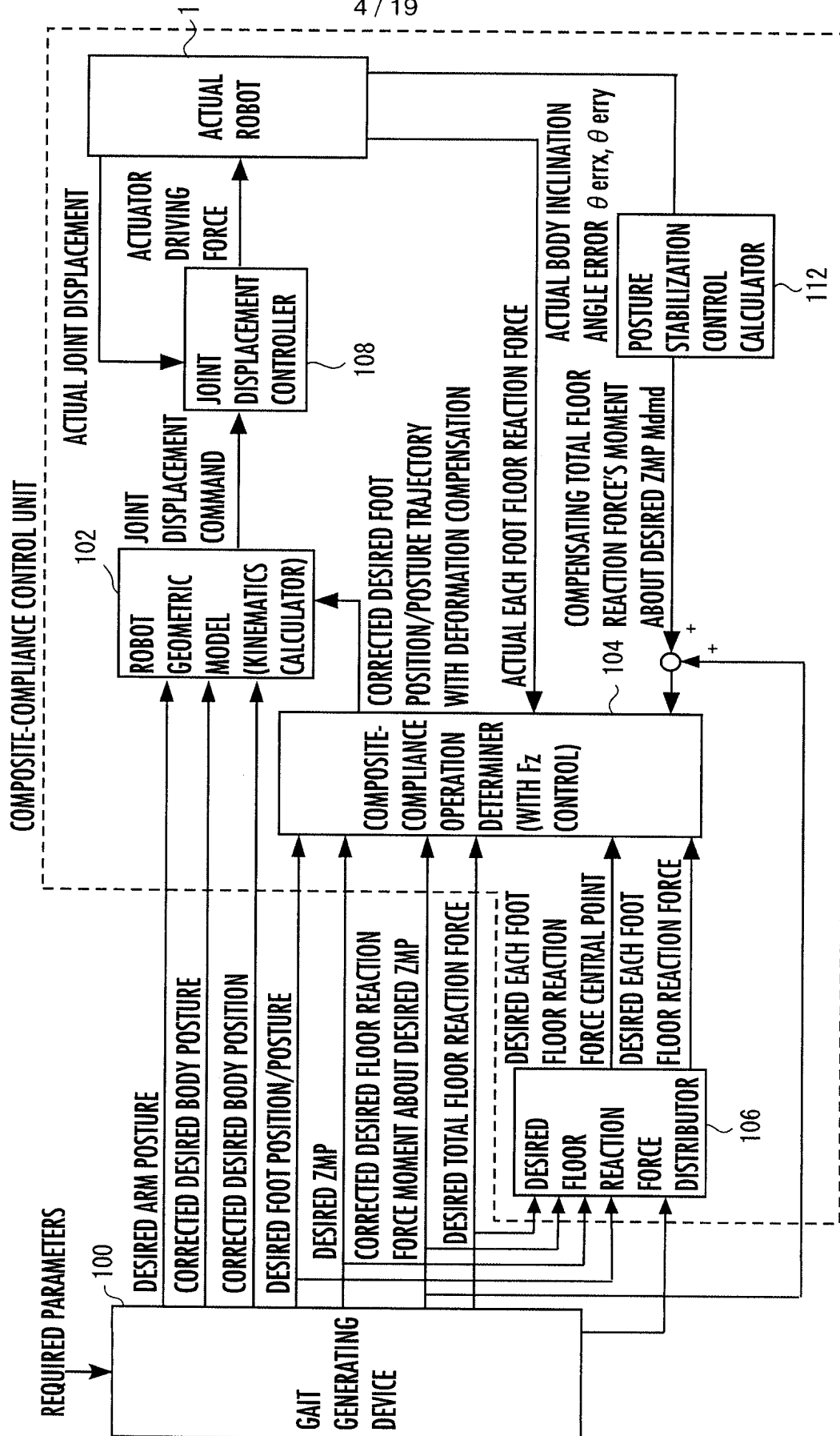


FIG. 4



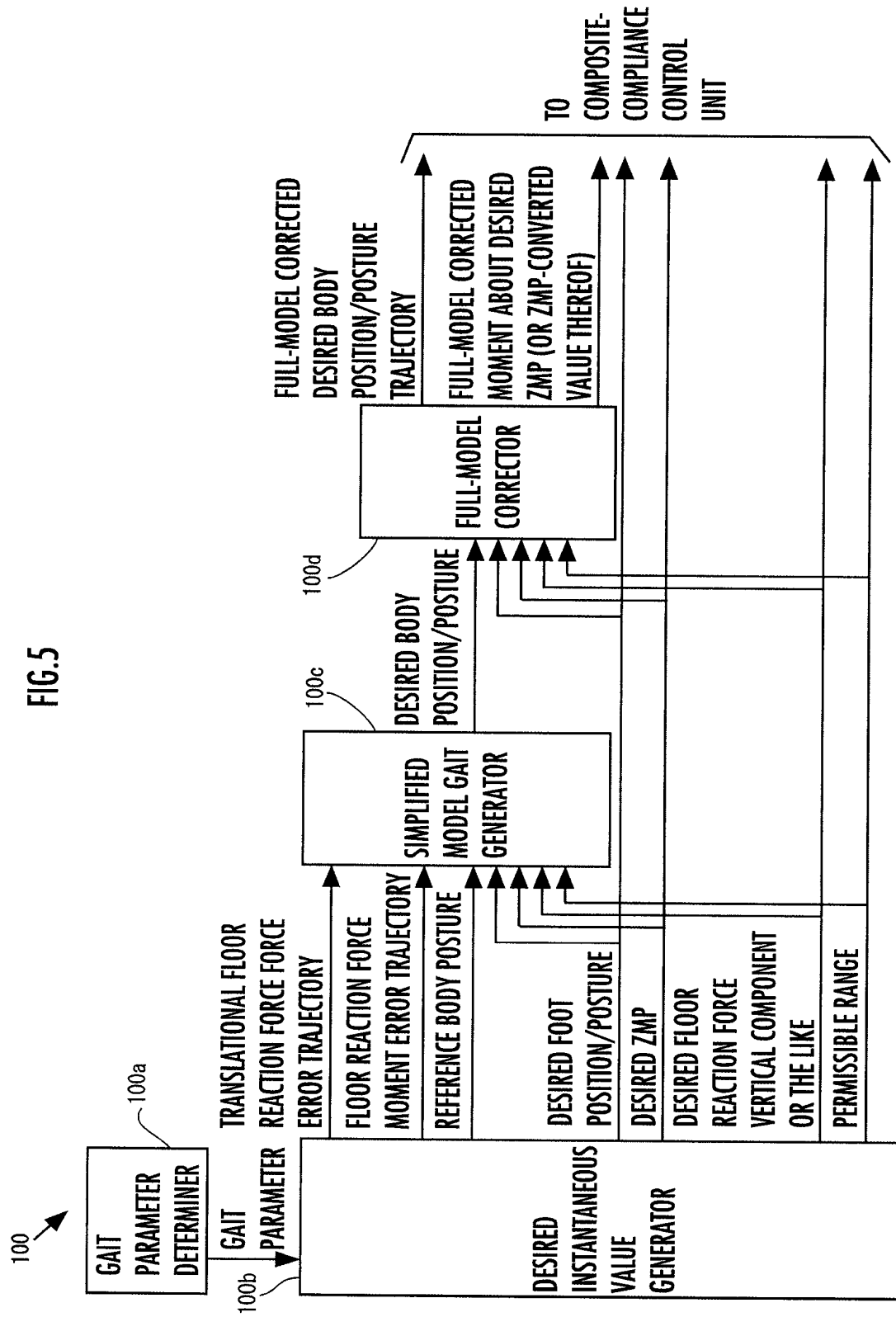


FIG.6(a)

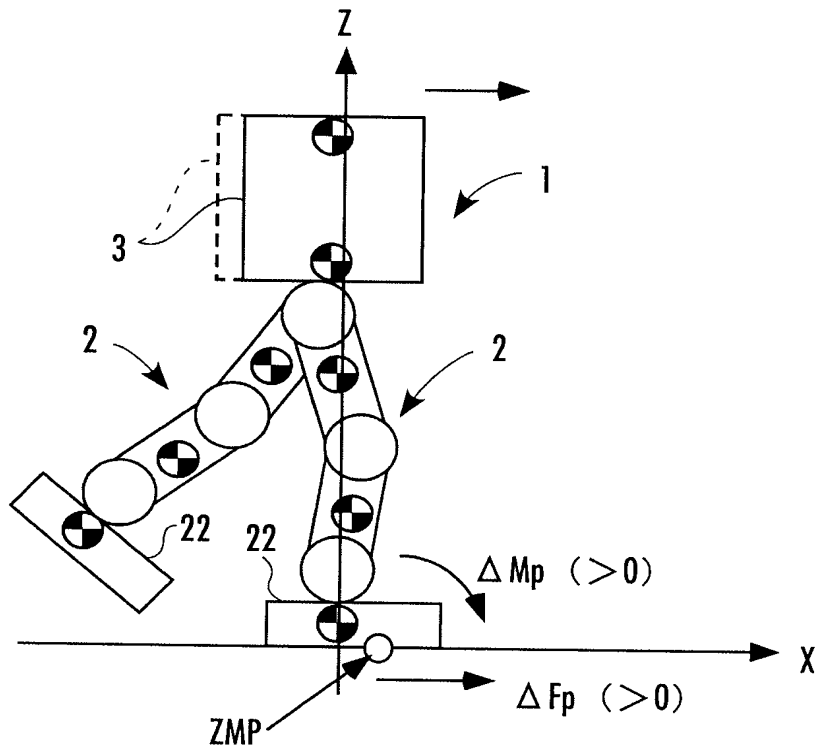


FIG.6(b)

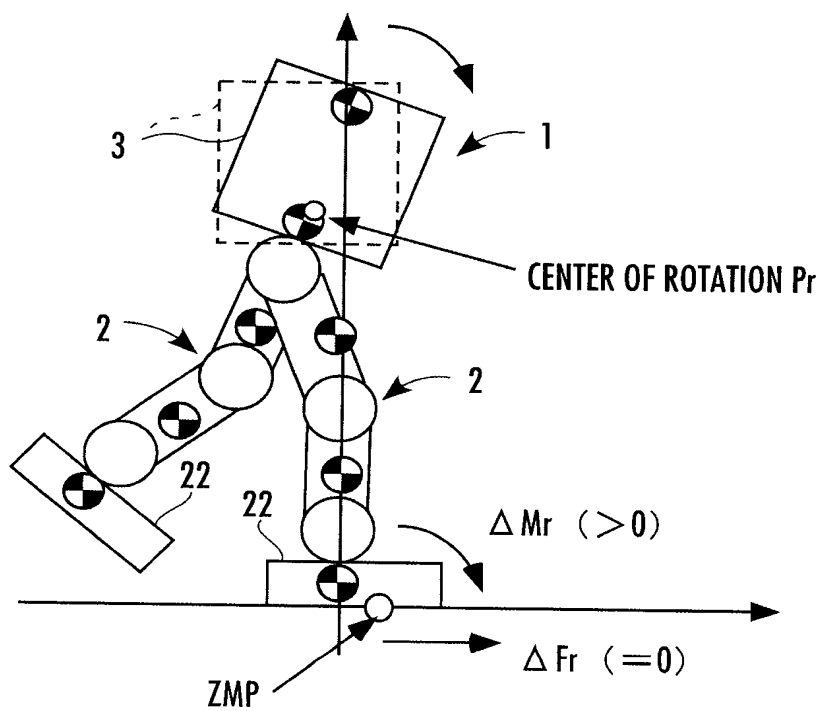


FIG.7

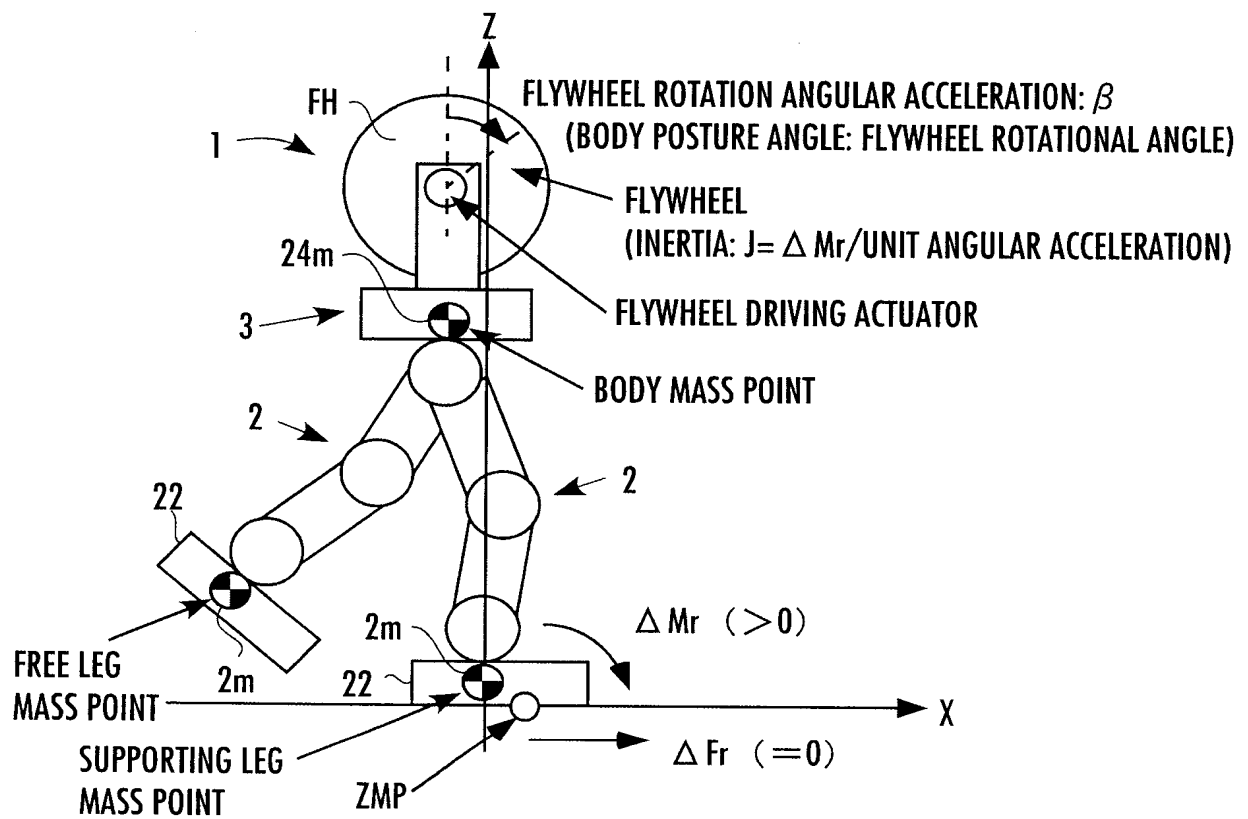


FIG.8

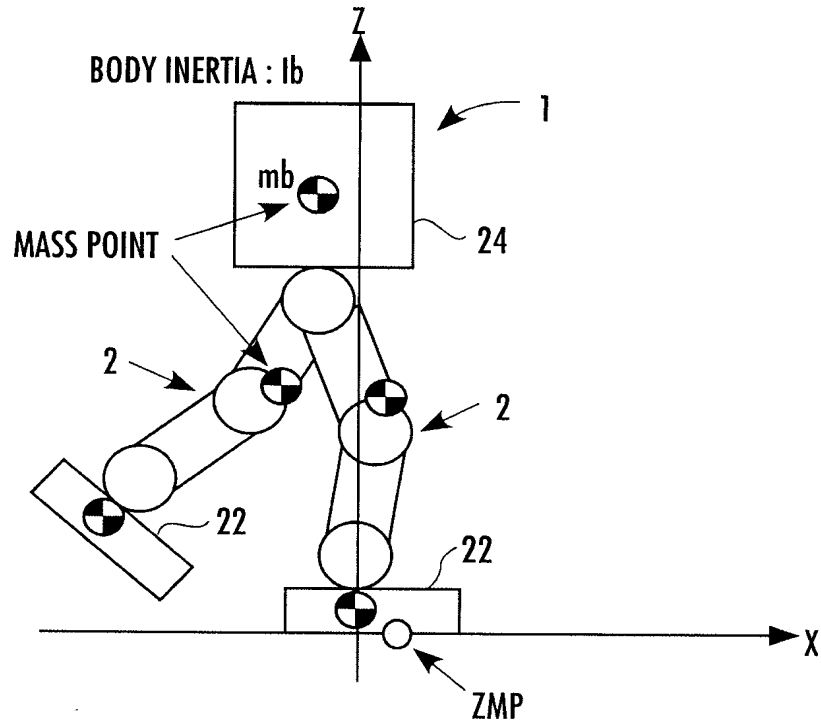


FIG.9

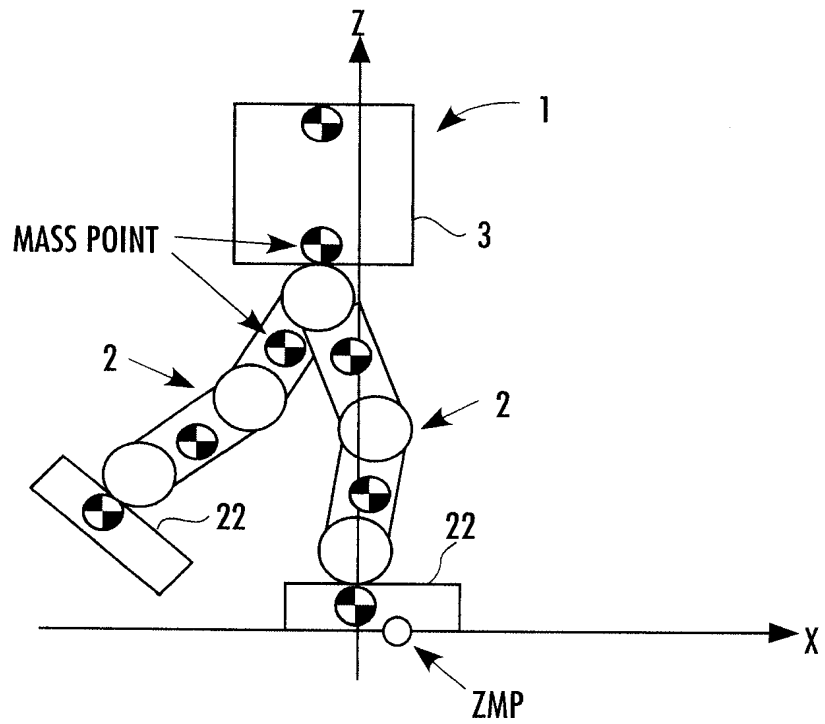


FIG.10

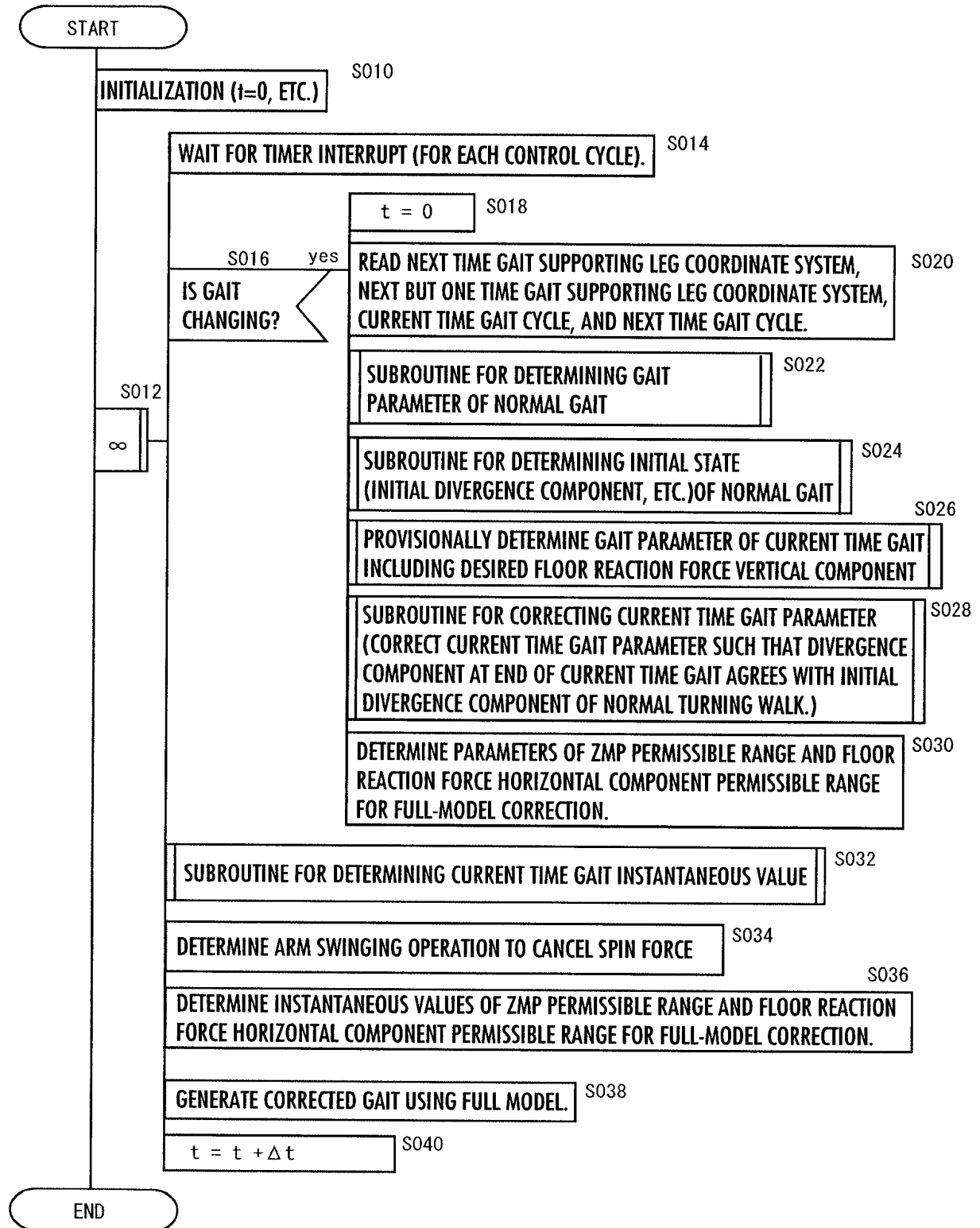
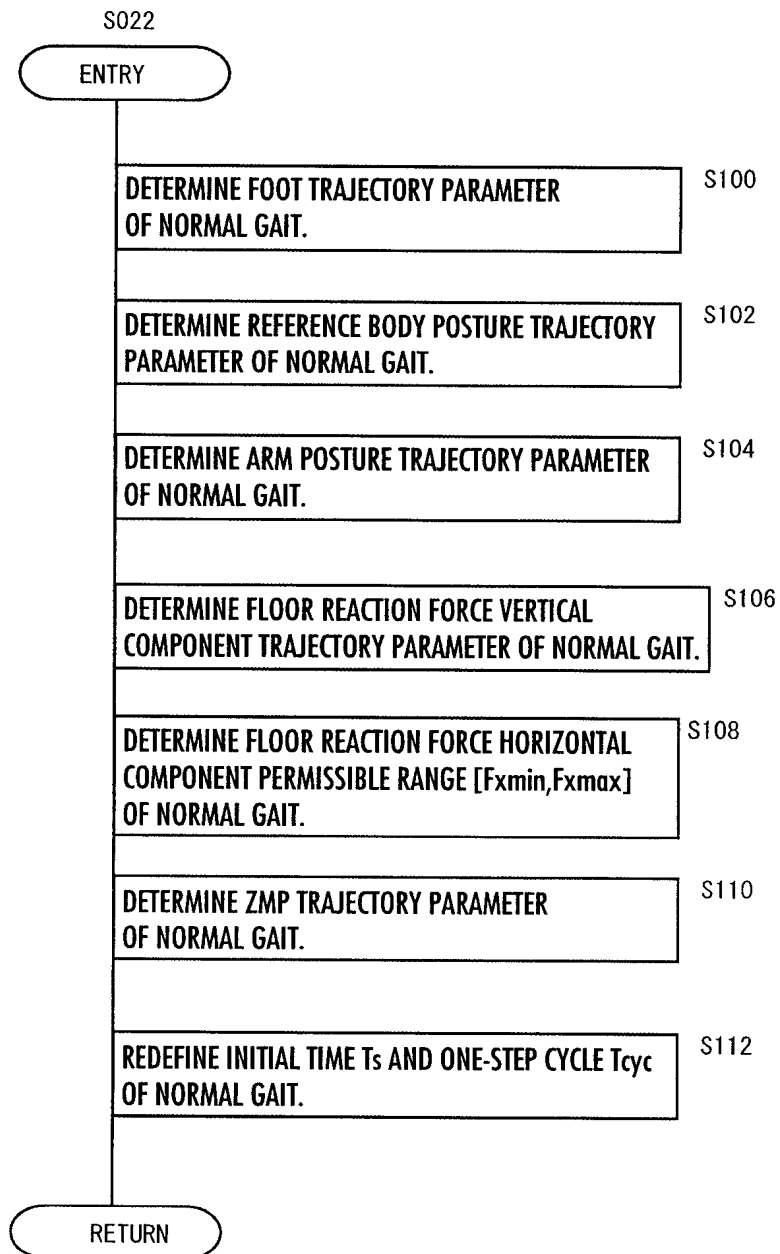


FIG.11



ENTRY

FIG.12

DETERMINE INITIAL STATES (STATES AT INITIAL TIME T_s) OF FOOT POSITION/POSTURE, BODY POSTURE ANGLE θ_{bs} , AND ARM POSTURES ON THE BASIS OF NORMAL TURNING GAIT PARAMETER. S200

PROVISIONALLY DETERMINE INITIAL (AT T_s) BODY HORIZONTAL POSITION, VELOCITY, ANGULAR VELOCITY, AND BODY INCLINATION RESTORING MOMENT ZMP-CONVERTED VALUE PEAK VALUE CANDIDATES ($X_s, V_{xs}, \omega_{bs}, ZMP_{prepeak}$). S202

DETERMINE INITIAL BODY VERTICAL POSITION/VELOCITY (Z_s, V_{zs}). S206

USING DYNAMIC MODEL, GENERATE GAIT FOR ONE STEP ON THE BASIS OF NORMAL TURNING GAIT PARAMETER INCLUDING $ZMP_{prepeak}$, TAKING $\theta_{bs}, (X_s, V_{xs}, \omega_{bs}), (Z_s, V_{zs})$ AS INITIAL STATES OF BODY. S208

CONVERT TERMINAL BODY POSITION, VELOCITY, POSTURE ANGLE, AND ANGULAR VELOCITY OF GENERATED GAIT INTO VALUES OBSERVED FROM SUPPORTING LEG COORDINATE SYSTEM OF NEXT STEP, AND DENOTE THE VALUES BY ($X_e, V_{xe}, \theta_{be}, \omega_{be}$). S210

BOUNDARY CONDITION ERRORS ($err_x, err_v, err_{\theta}, err_{\omega}$) S212
 $= (X_s, V_{xs}, \theta_{bs}, \omega_{bs}) - (X_e, V_{xe}, \theta_{be}, \omega_{be})$

 ∞

S214 yes

LEAVE REPETITION LOOP.

ARE ALL $err_x, err_v, err_{\theta}$, AND err_{ω} WITHIN PERMISSIBLE RANGES?

DETERMINE A PLURALITY OF CANDIDATES ($X_{s+\Delta}, V_{xs}, \omega_{bs}, ZMP_{prepeak}$), ($X_s, V_{xs+\Delta}, \omega_{bs}, ZMP_{prepeak}$), ($X_s, V_{xs}, \omega_{bs+\Delta}, ZMP_{prepeak}$), ($X_s, V_{xs}, \omega_{bs}, ZMP_{prepeak+\Delta}$) IN THE VICINITY OF ($X_s, V_{xs}, \omega_{bs}, ZMP_{prepeak}$), AND BASED ON THEM, DETERMINE BOUNDARY CONDITION ERROR CORRESPONDING TO EACH OF THEM AS DESCRIBED ABOVE. S216

DETERMINE NEW CANDIDATES ($X_s, V_{xs}, \omega_{bs}, ZMP_{prepeak}$) ON THE BASIS OF BOUNDARY CONDITION ERRORS CORRESPONDING TO ($X_s, V_{xs}, \omega_{bs}, ZMP_{prepeak}$) AND EACH OF CANDIDATES IN THE VICINITY THEREOF. S218

DETERMINE INITIAL BODY POSITION, VELOCITY, POSTURE ANGLE, AND ANGULAR VELOCITY ($X_0, V_{x0}, \theta_{b0}, \omega_{b0}$), INITIAL BODY VERTICAL POSITION AND VELOCITY (Z_0, V_{z0}), AND INITIAL BODY POSTURE ANGLE AND ANGULAR VELOCITY AT ORIGINAL INITIAL TIME 0. S220

DETERMINE NORMAL TURNING INITIAL DIVERGENCE COMPONENT $q[0]$ S222
 ACCORDING TO THE FOLLOWING EXPRESSION.
 $q[0] = X_0 + V_{x0} / \omega_0$

DETERMINE q'' , WHICH IS THE VALUE OF NORMAL TURNING INITIAL DIVERGENCE COMPONENT $q[0]$ OBSERVED FROM SUPPORTING LEG COORDINATE SYSTEM OF CURRENT TIME GAIT, AND (Z_0'', V_{z0}''), WHICH ARE VALUES OF INITIAL BODY VERTICAL POSITION AND VELOCITY OBSERVED FROM SUPPORTING LEG COORDINATE SYSTEM OF CURRENT TIME GAIT. S224

RETURN

FIG.13

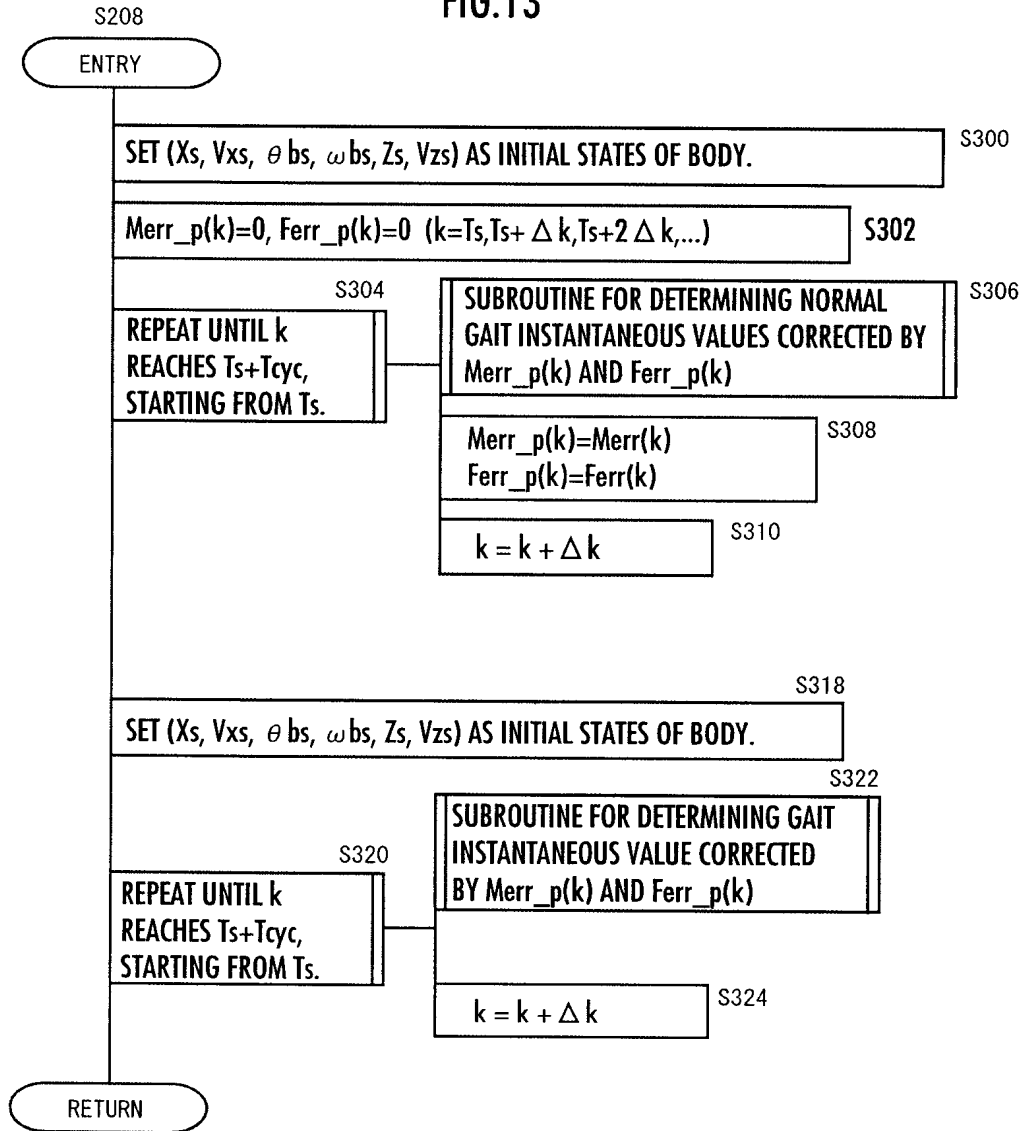


FIG.14

S306 or S322 or S032

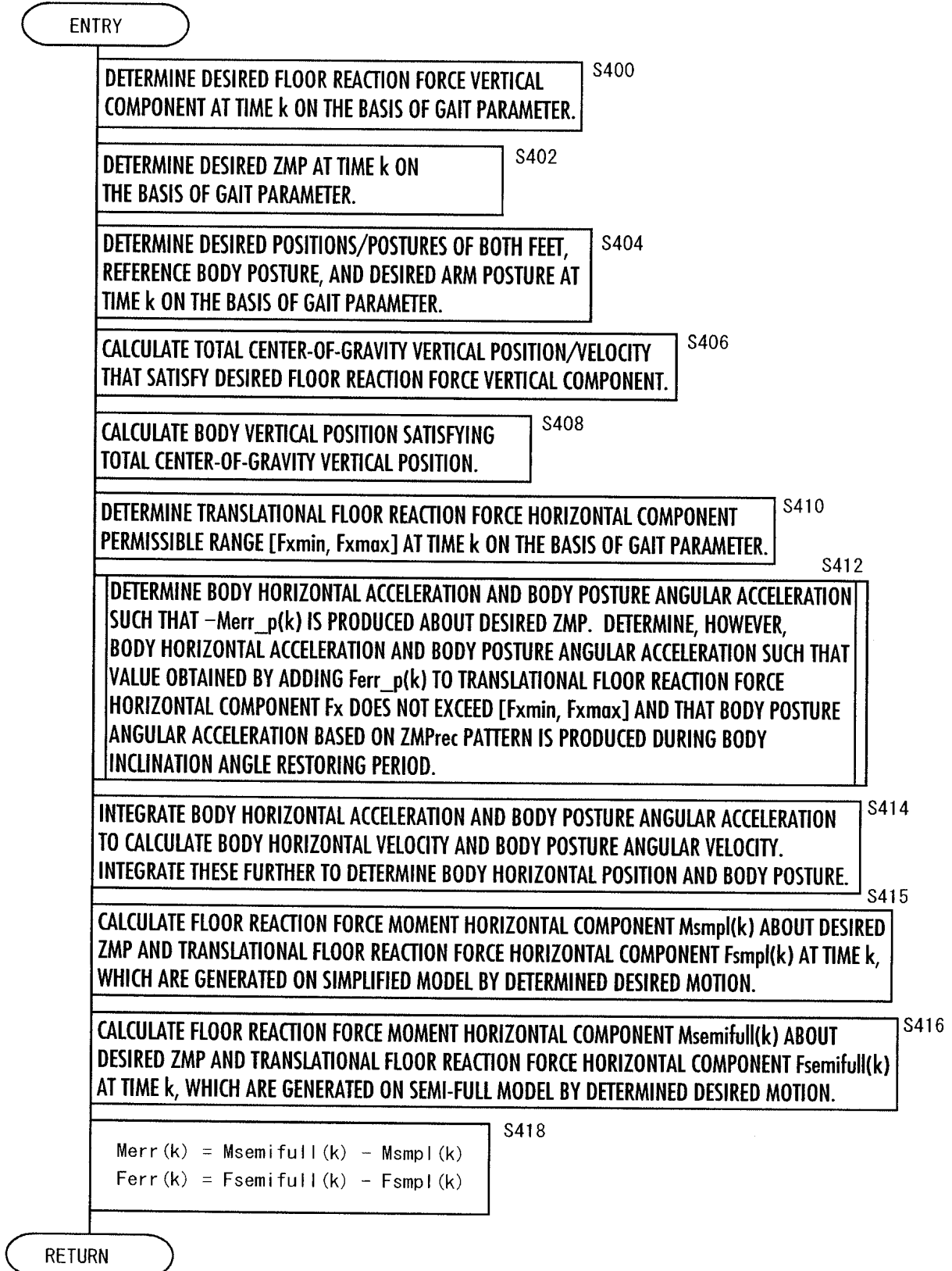


FIG.15

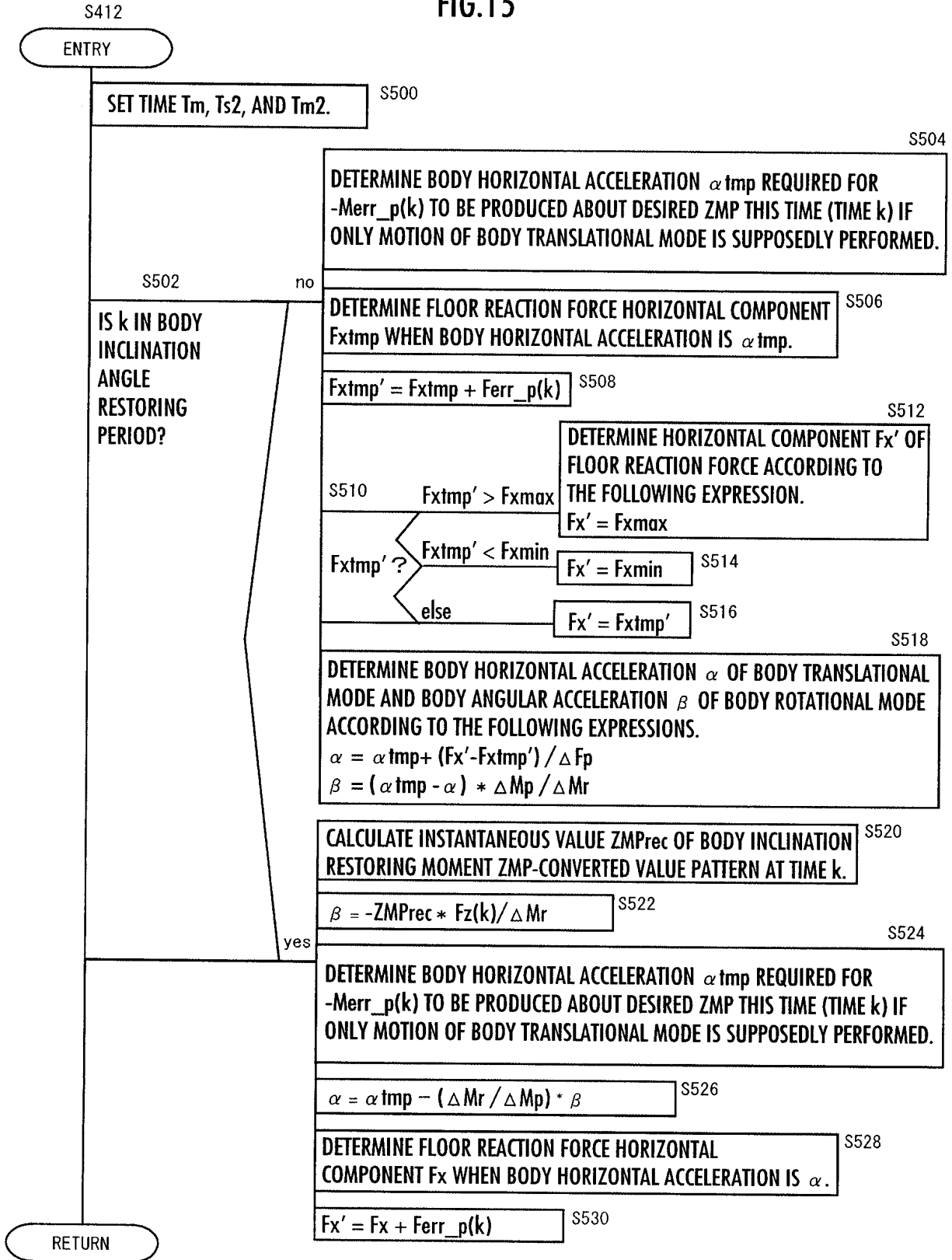


FIG.16

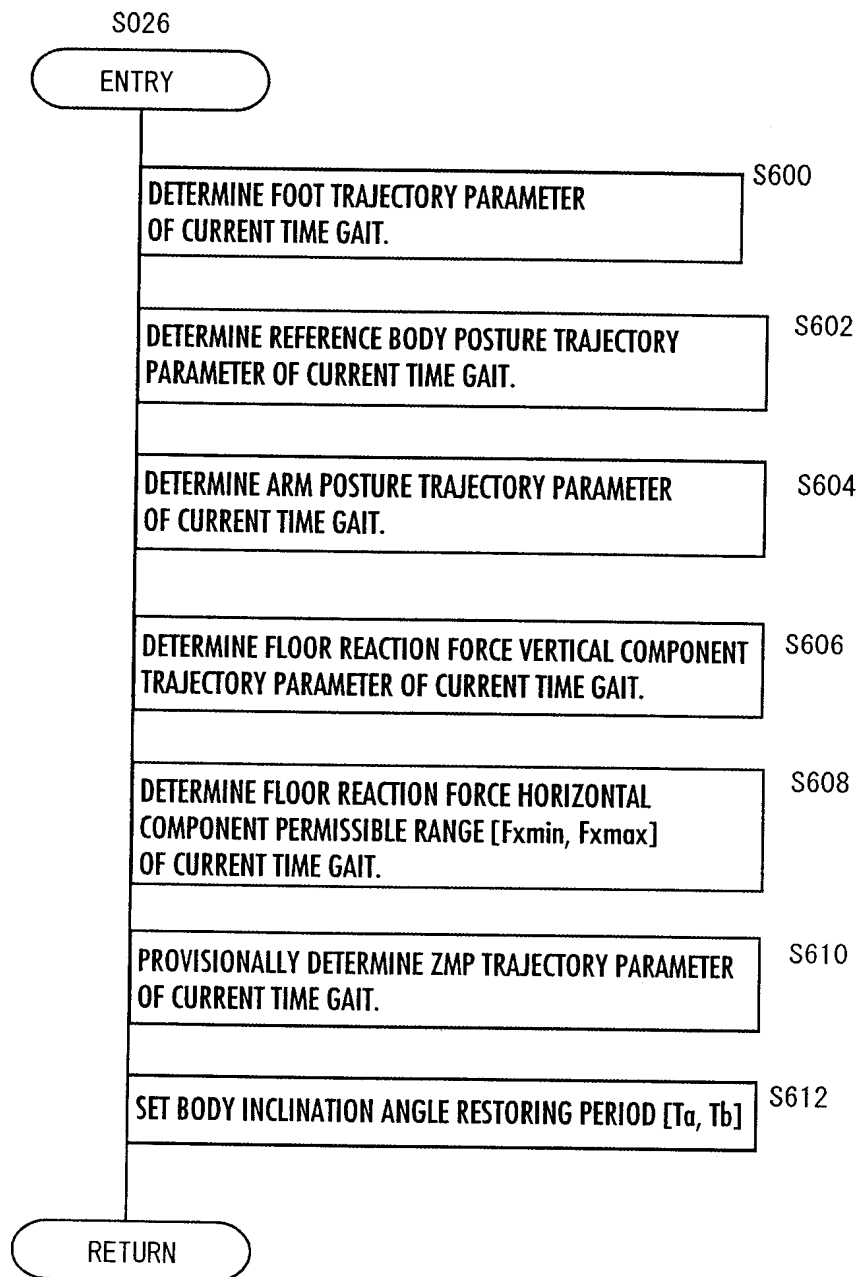


FIG.17

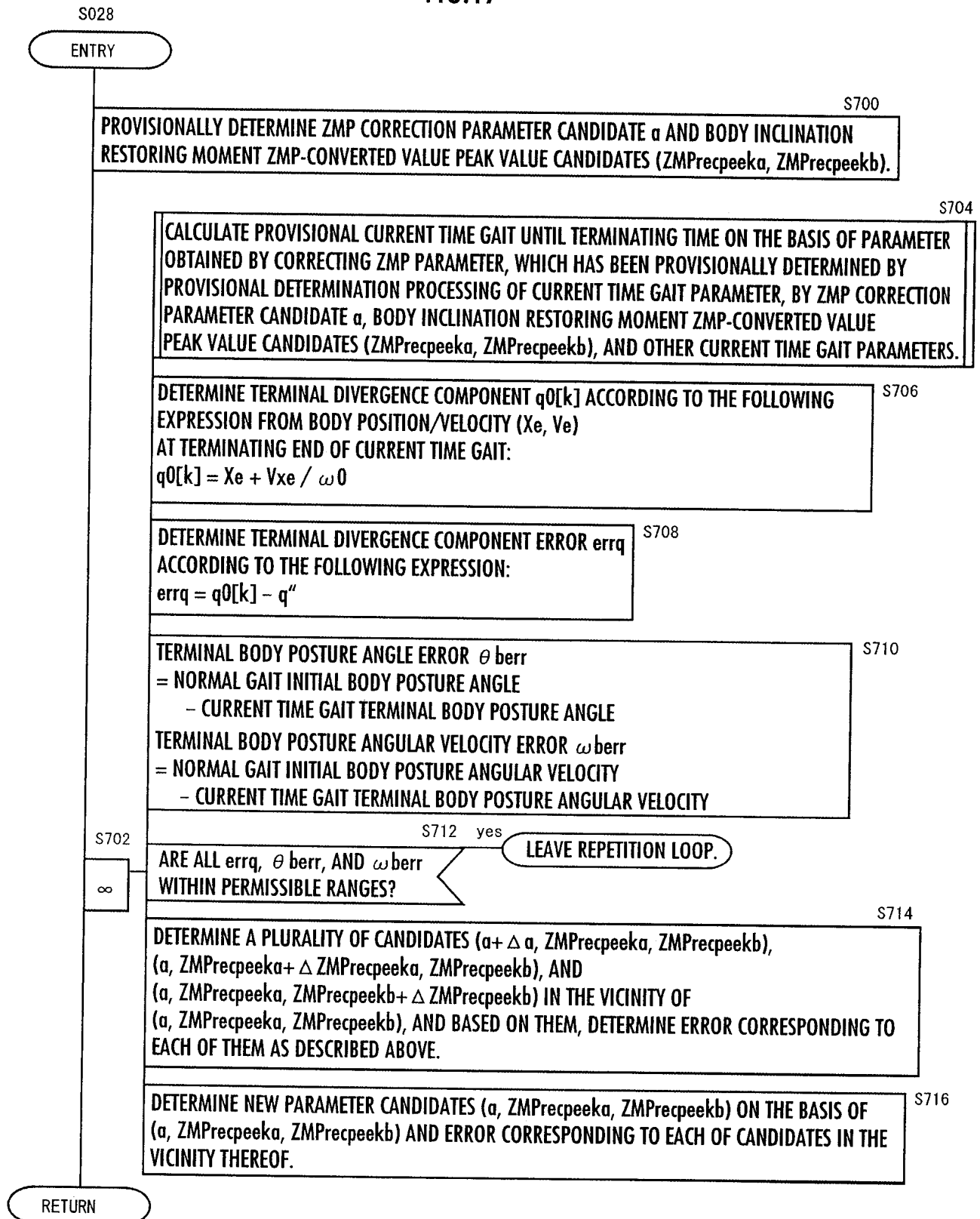


FIG.18

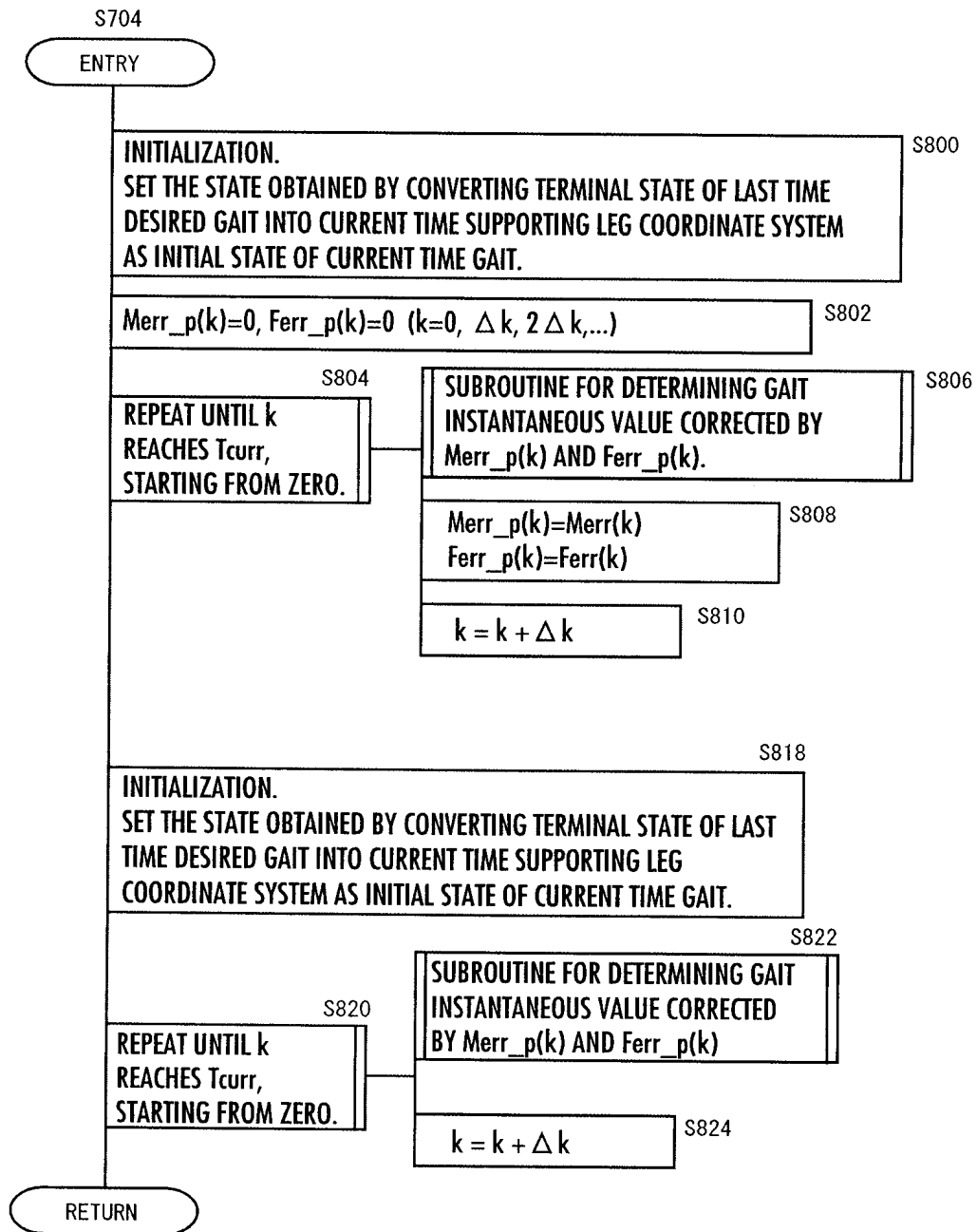


FIG.19

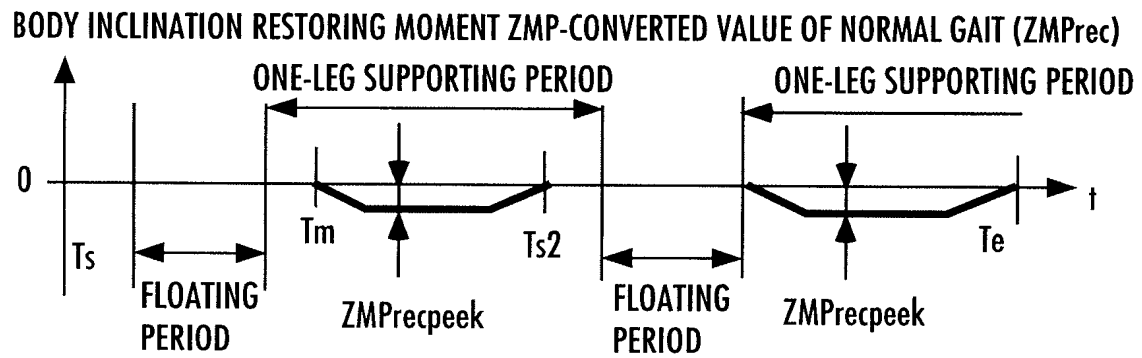


FIG.20

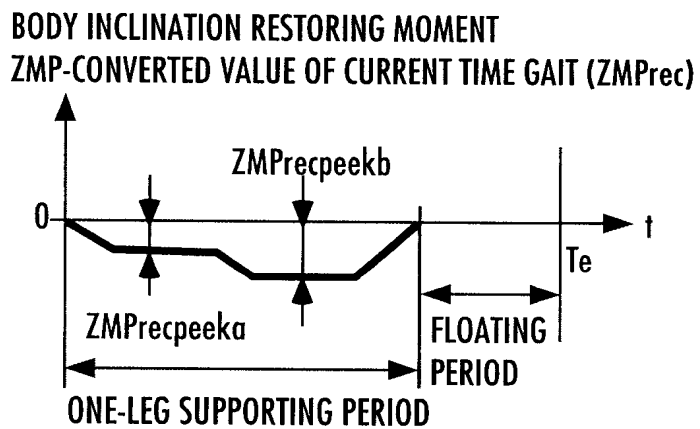


FIG.21

